

# Effect of posture on swallowing.

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## Abstract

**Background:** Swallowing is a systematic process. Any structural, physiological or neurological disturbance in this process may cause dysphagia. Although there are studies that report head/neck movements during mastication, there are fewer studies that show the effect of different head/neck postures on difficulty while swallowing.

**Objectives:** To observe the effect of different body postures on the self-perceived difficulty while swallowing in normal healthy subjects.

**Methods:** Participants were asked to swallow 25 ml of water in one go while sitting upright, sitting with head/neck flexed, head/neck extended and lying supine. Following this, they had to rate their self-perceived difficulty while swallowing on a scale of 0-10, 0 being most easy and 10 being most difficult.

**Results:** 186 subjects with mean age 32.7 SD 9.04 participated in this study. It was found to be least difficult to swallow when subjects were asked to swallow in upright sitting position. Statistically significant differences were found between sitting upright, sitting with head/neck flexed, head/neck extended and lying supine.

**Conclusion:** Postural modification may help in rehabilitation of patients with dysphagia by affecting bolus flow to improve speed and safety of swallowing by closure of airways to prevent aspiration.

**Keywords:** Swallowing, posture, dysphagia.

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## Introduction

Swallowing involves a predictable and systematic process.<sup>1</sup> Any structural, physiological or neurological disturbance in this process may cause dysphagia.<sup>2</sup> Approximately, 33 to 73% of patients are reported to suffer dysphagia following stroke, motor neuron disease, Parkinson's disease, cerebral palsy, etc.<sup>3,4</sup> It can further lead to aspiration pneumonia, dehydration, malnutrition and other serious complications.<sup>5</sup> Clinical presentation may vary from patient to patient and that needs to be taken into consideration while planning rehabilitation.<sup>6,7</sup> Various techniques have

been proposed to improve the swallowing function that can improve patient's quality of life.<sup>2,8</sup>

Mandibular movements during mastication have been shown to cause head movements.<sup>9,10</sup> Chewing induces head extension due to co-contraction of sternocleidomastoid and trapezius muscles along with jaw muscles.<sup>11,12</sup> These movements facilitate effective chewing of the bolus,<sup>13</sup> in preparation for swallowing. Although there are studies that report head/neck movements during mastication, there are fewer studies that show the effect of head/neck position on difficulty while swallowing. Head flexion and extension has been shown to decrease the opening of airways and esophagus.<sup>14</sup> Modification of body position can help to improve rehabilitation of such patients. In this study, we decided to see the effect of different body postures while sitting and lying on swallowing in normal healthy subjects.

## Methods:

Two hundred healthy adult males, aged between 20-40 years, were invited to participate in this study. They were assessed for any neurological or musculoskeletal pain and excluded if any sign or symptom was found to be present.

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They were informed about the nature of study and required to provide informed consent. This study was conducted after receiving ethical clearance from institutional review board.

Participants were asked to swallow 25 ml of water in one go while sitting upright, sitting with head/neck flexed, head/neck extended and lying supine. Following this, they had to rate their self-perceived difficulty while swallowing on a scale of 0-10, 0 being most easy and 10 being most difficult.

Statistical difference was tested by Friedman test non-parametric repeated measures ANOVA using Graph-Pad Instat 3.0 GraphPad Software Inc., CA, USA. The difference was considered significant for p values less than 0.05.

**Results**

After testing for inclusion and exclusion criteria, 186 subjects with mean age 32.70 SD 9.04 participated in this study. Mean SD for self-perceived difficulty while swallowing has been presented in table 1.

**Table 1 – Self-perceived difficulty while swallowing on scale of 0-10, 0 being most easy and 10 being most difficult**

|             | <b>Sitting upright</b> | <b>Sitting with head/neck flexed</b> | <b>Sitting with head/neck extended</b> | <b>lying supine</b> |
|-------------|------------------------|--------------------------------------|--|---------------------|
| <b>Mean</b> | 0.52                   | 2.79                                 | 4.69                                   | 6.96                |
| <b>SD</b>   | 0.75                   | 1.22                                 | 1.53                                   | 1.59                |

In comparison of all tested postures, self-perceived difficulty for swallowing was found to be least while subjects were sitting upright. Statistically significant differences

were found between sitting upright, sitting with head/neck flexed, head/neck extended and lying supine. Table 2.

**Table 2 – Comparison of swallowing during different postures**

| <b>Postures</b>                                 | <b>Significance</b> |
|---|---------------------|
| <b>Upright sitting vs head/neck flexion</b>     | ***                 |
| <b>Upright sitting vs head/neck extension</b>   | ***                 |
| <b>Upright sitting vs supine lying</b>          | ***                 |
| <b>Head/neck flexion vs head/neck extension</b> | ***                 |
| <b>Head/neck flexion vs supine lying</b>        | ***                 |
| <b>Head/neck extension vs supine lying</b>      | ***                 |

\*\*\* Extremely significant, p<0.001

**Discussion**

We saw the effect of different body postures on the self-perceived difficulty while swallowing in normal healthy subjects. It was found to be least when subjects were asked to swallow in upright sitting position. Statistically significant differences were found between sitting upright, sitting with head/neck flexed, head/neck extended and lying supine.

There are individual differences in swallowing and dysphagia limit depending on individual condition, preferences and habits. However, different head and neck positions can facilitate the process of swallowing to eliminate aspiration; etc.<sup>15,16</sup> that can help patients with various dysfunctions. Various changes occur in mechanism of swallowing with aging, including slowing of oral stage and trigger of pharyngeal swallow.<sup>17</sup>

It has been shown that while swallowing different volumes of water, healthy adults didn't experience piecemeal deglutition or aspiration; however while swallowing with head in extension physiologic dysphagia was seen.<sup>18,19</sup> Similarly, our results also show that subjects reported maximum difficulty in swallowing while sitting with head and neck in extension. During neck extension, there is mechanical widening of laryngeal vestibule and narrowing of valleculae, leading to decrease in upper esophageal sphincter relaxation and difficulty in its closure.<sup>20,21</sup> This position should be avoided while training patients with various swallowing disorders.

Chin tuck position makes the vallecular space wide and airway entrance narrow to prevent aspiration.<sup>22,23</sup> It also decreases pharyngeal contraction to decrease dysphagia limit.<sup>24,25</sup> There is reduction in all the measured distances in the pharynx with flexion of head and neck.<sup>24</sup> Swallowing with chin tuck is one of the commonly used techniques to facilitate swallowing and prevent aspiration.<sup>23,24</sup> Our results show that swallowing while sitting with head/neck flexed was comparatively easier than that in extension position but more difficult than while sitting upright. This could be due to increased muscle tension in this position. Tension leads to shortening of muscles of base of tongue that lifts the hyoid bone and decreases laryngeal elevation.<sup>24</sup>

During chin tuck position distance between the larynx and hyoid bone, and hyoid bone and mandible bone has been shown to lessen as compared to head/neck extension position.<sup>24</sup> This causes laryngeal elevation, closure of airways and reduction of pharyngeal peak contraction.<sup>21,25</sup> This could be an ideal position to prevent aspiration. Rotation of head can facilitate more efficient swallowing by directing the flow of bolus towards more sensitive and stronger side of pharynx where pharyngeal cavities are closed.<sup>26</sup> It also facilitates the opening of the upper esophageal sphincter.<sup>27</sup>

To facilitate swallowing combination of different techniques is often recommended while rehabilitating patients with oropharyngeal dysfunction.<sup>28,29</sup> Mechanism of swallowing varies with different techniques. However, consideration of posture while application of such techniques is often not done. In this study, we saw the effect of different body postures on self-perceived difficulty while swallowing in normal healthy subjects. Subjects reported that in comparison to sitting with head/neck extended

and lying supine, swallowing was easiest while sitting upright and head/neck flexed. Postural modification may help in treatment of dysphagia by affecting bolus flow to improve speed and safety of swallowing by closure of airways to prevent aspiration.

### Limitations

Our study was done in normal subjects who had a fixed pattern of swallowing. Most of the studies available in literature use video fluoroscopy, manometry and other electrophysiological investigations as outcome measures<sup>27,30</sup> in dysphagia patients. Due to ethical reasons we could not expose our subjects to such radiation; hence we used only self-perceived difficulty while swallowing as an outcome measure. Similar studies in dysphagia patients, who present with individual variation in the process, would reveal a better picture on how a specific posture can affect swallowing pattern.

### Conflict of interest

Authors have no Conflict of interest to declare.

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